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ABSTRACT

Learning and Integrating New Knowledge and Skills (LINKS) was a technology project designed to integrate established and emerging technologies into the teacher preparation program at Texas Woman's University (TWU). The project was supported by a U.S. Department of Education, Preparing Tomorrow's Teachers to Use Technology (PT3) grant. The LINKS project encouraged institutionalized efforts by prompting change in university faculty involvement and roles, technology curriculum content and delivery, and preservice teachers' performance and responsibilities in field-based locations. This study's purpose is to describe changes in institutional processes as well as changes in behaviors and attitudes of faculty, mentor and supervising teachers, and preservice teachers during the second year of implementation. Specifically, the study addresses these questions: (1) how did LINKS support technology infusion in teacher preparation; (2) to what extent did preservice teachers build technological skills and understanding; (3) how did mentor and supervising teachers build technological skills and serve as guides of technology integration; (4) to what extent did university instructors build proficiency for Web-based course delivery and model technology integration for preservice teachers; and (5) what progress was made toward institutionalizing the LINKS efforts toward infusion of technology into classroom courses across disciplines, education courses in particular, and the university overall? (Author)

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Learning to Integrate Technology Lessons Learned Learned from a PT3 Implementation Project

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Key Words. Technology Integration; Preservice Teacher Education; Faculty Development; Technology Standards; PT3

Abstract

Learning and Integrating New Knowledge and Skills (LINKS) was a technology project designed to integrate established and emerging technologies into the teacher preparation program at Texas Woman's University (TWU). The project was supported by a U.S. Department of Education, PT3 grant. The LINKS project encouraged institutionalized efforts by prompting change in university faculty involvement and roles, technology curriculum content and delivery, and preservice teachers' performance and responsibilities in field-based locations. This study's purpose was to describe changes in institutional processes as well as changes in behaviors and attitudes of faculty, mentor and supervising teachers, and preservice teachers during the second year of implementation. Specifically, the study addressed these questions: (a) how did LINKS support technology infusion in teacher preparation, (b) to what extent did preservice teachers build technological skills and understanding, (c) how did mentor and supervising teachers build technological skills and serve as guides of technology integration, (d) to what extent did university instructors build proficiency for web-based course delivery and model technology integration for preservice teachers; and (e) what progress was made toward institutionalizing the LINKS efforts toward infusion of technology into classroom courses across disciplines, education courses in particular, and the university overall?

Learning to Integrate Technology: Lessons Learned from a PT3 Implementation Project

Learning and Integrating New Knowledge and Skills (LINKS) was a three-year technology project supported by a U.S. Department of Education's Preparing Tomorrow's Teachers to Use Technology (PT3) grant. Implemented at Texas Woman's University (TWU), LINKS redesigned TWU's teacher education program to address the technology proficiencies required by schools, recommended by the National Council for the Accreditation of Teacher Education (NCATE), and delineated by professional associations. The project encouraged development of university faculty's ability to use and model web-based technologies, changes in teacher education technology curriculum content and delivery, and enhancement of preservice teachers' performance requirements and responsibilities in field-based locations.

This study's purpose was to describe changes in TWU's institutional processes as well as changes in behaviors and attitudes of faculty, mentor and supervising teachers, and preservice teachers as impacted by the LINKS project during the second year of the three-year project. Specifically, the study addressed these questions: (a) how did LINKS support technology infusion in teacher preparation, (b) to what extent did preservice teachers build technological skills and understanding, (c) how did mentor and supervising teachers build technological skills and serve as guides of technology integration, (d) to what extent did university instructors build proficiency for web-based course delivery and model technology integration for preservice teachers; and (e) what progress was made toward institutionalizing the LINKS efforts toward infusion of technology into classroom courses across disciplines, education courses in particular, and the university overall?

Background

For decades colleges of education have endeavored to integrate technology into their teacher education programs. As early as 1990, Ball State University's Center for Information and Communication Sciences conducted a survey of 282 colleges of teacher education and found that "almost all [were] implementing changes" to integrate technology into their programs to help their teacher education "students to function in the information age" (as cited in Faison, 1994).

With the rapid advances in technology and the changing face of the Internet, colleges of education found it difficult to keep pace. Although intentions were good, outcomes were mixed. Indeed, in 1995, OTA's report, "Teachers and Technology: Making the Connections," found that "overall teacher education programs . . . [did] not prepare graduates to use technology as a teaching tool" (p.184). Not surprisingly, more recent reports suggest that new teachers entering classrooms are unprepared to use technology to its full potential (CEO Forum on Education and Technology, January 2000). Even though 66% of teachers report using computers or the Internet for instruction, most lessons fail to involve complex inquiries, exploration, or problem-solving activities (NCES, 2000). Furthermore, only 33% of teachers feel either "well prepared" or "very well prepared" to use technology.

The challenge for higher education institutions today, particularly colleges of education, is to create a place where preservice teachers learn to employ a variety of technology tools to improve the effectiveness of their instruction. Currently, the debate centers on the best means to integrate technology into teacher education programs. Approaches range from simply encouraging students to use email to more advanced programs advocating the infusion of technology into all aspects of the teacher education curriculum. Innovations that have been implemented with varying success include electronic contacts via email, listservs, and dialogue (Blake, 1998; McIntyre & Tlusty, 1995); virtual workshops and add-on coursework (Simmons &

Linnell, 1998, Veen, Lam, & Taconis, 1998), as well as comprehensive, integrated approaches (Dradowski, 1998; Parker & Farrelly, 1994, Schrum, 1998).

Concerns about individual attitudes and perceptions that pose significant barriers to technology integration have been the focus of other research efforts (Blake, 1998; Buhendwa, 1996, Medcalf & Davenport, 1999; Smithey & Hough, 1999; Strudler & Wetzel, 1999). Though much research has been conducted, according to Shaw (1998) in his Report to the President on the Use of Technology to Strengthen K-12 Education in the United States, "a large scale program of rigorous, systematic research on …educational technology…will ultimately prove necessary to ensure both the efficacy and cost-effectiveness of technology use within our nation's K-12 schools" (p. 115). As a result of these types of directives, national educational technology standards for students and teachers have been developed and are specified by ISTE (2000).

The Study

The LINKS project was integrated into the existing curriculum for teacher preparation in TWU's College of Professional Education. Each semester, approximately 300 future teachers progressed through university coursework, technology seminars, documentation of proficiencies, and field-based placements. Responsibility for preparing students was divided among university instructors, technology seminar leaders, university liaisons, and supervising teachers in the field. As illustrated in Figure 1, the LINKS project addressed the technology needs of preservice teachers by supporting their development through three semesters of coursework and field-based experiences (Intern I, Intern II, and Resident), as well as the associated development of their university instructors, and mentor and supervising teachers.

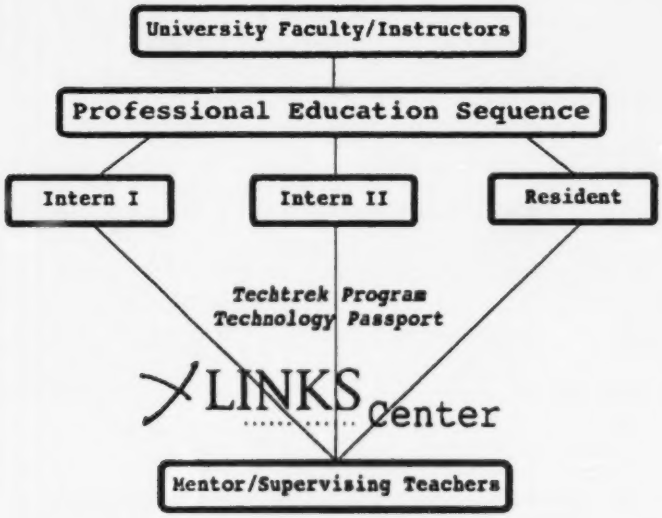

Figure 1. Texas Woman's University (TWU) Teacher Education Program.

In the first two years of the project (fall 1999-spring 2001), implementation and outcome data were collected for events involving three populations: (1) preservice teachers (three disparate cohort groups), (2) mentor and supervising teachers, and (3) university instructors.

Populations and Program

Preservice teachers. In the LINKS preservice strand, students progressed through Intern I, Intern II, and Residency over three semesters. This study focused on the second and third cohort groups. Cohort 2 included 62 Intern II(s) in fall 2000, 41 of which continued as Residents in spring 2001. For Cohort 3, 66 preservice teachers participated as Intern I(s) in fall 2000, and 62 progressed to Intern II(s) in spring 2001. Table 1, shown below, indicates the nature of the cohort distribution.

Table 1
Data Collection Patterns for Preservice Teacher Cohort Groups Progressing Through Intern I, Intern II, and Residency

Preservice	Year 1		Year 2		Year 3	
Teachers	Fall 1999	Spring 2000	Fall 2000	Spring 2001	Fall 2001	Spring 2002
Cohort 1	Intern I	Intern II	Resident	-	-	-
Cohort 2	-	Intern I	Intern II	Resident	-	-
Cohort 3	-	-	Intern I	Intern II	Resident	-

Note. Data collection instruments and procedures varied for Intern I, Intern II, and Residents. No data from Year 1 will be included in this report.

As Intern I(s) and Intern II(s), preservice teachers participated in various integrated technology seminars, bi-weekly online conferencing groups, lab sessions related to individual, developmental needs and, documented progress according to the associated four cornerstones of the program: (1) foundations; (2) connectivity; (3) productivity; and (4) integration. During Residency, preservice teachers began their student teaching and attended two full-day technology seminars. All student activities were supported through the TechTrek technology integration curriculum via online and face-to-face experiences. The technology curriculum was not part of a separate methods course. Instead, it supported preservice teachers' use of established technologies within an integrated context of meaningful learning as an integral part of the established course work. Preservice teachers document competencies related to the four cornerstones utilizing a unique tool of the LINKS project, the Technology Passport (http://www7.twu.edu/~f_snider/links/techpassport/index.htm).

Mentor teachers and supervisors. Each semester, Interns interacted with mentor teachers during classroom observations. Mentors (N=30) participated in on-campus training sessions and received assistance designed to enhance receptivity toward technology use. During Residency, preservice teachers were paired with supervising teachers for their student teaching experience. A select group of supervising teachers (N=15) participated in specialized training dedicated to creating classroom appropriate technology products for use and evaluation in the classroom setting.

University instructors. Each year, a volunteer sample of university instructors (N=20) agreed to participate in professional development sessions. Two primary training goals included (1) the introduction of LINKS standards and resources and (2) support for instructor delivery of web-based courses as models for future teachers in their classes. The goals were implemented through a series of technology-training sessions including both whole-group professional

development sessions geared to broad topics and hands-on professional development sessions specializing in specific areas for remediation or advanced work.

Data sources

Implementation data came from reviews of project documents, attendance records, evaluation forms, information on LINKS-related web sites, and interviews with project staff. Additionally, the LINKS project evaluation measured the progress of project participants at various phases and assessed the utility and effectiveness of the LINKS training and resources. As shown in Table 2, data collection involved a variety of measures and varied among the three populations.

Table 2
LINKS Project Evaluation Measures

Measure	Acronym	Preservice Teachers	Supervising Teachers	University Instructors
Self-Evaluation Rubrics				
a. Basic Computer Use	BCU	✓	✓	
b. Advanced Computer Use	ACU	✓	✓	
c. Internet Use	IU	✓	✓	
CBAM: Stages of Concern Questionnaire	SoCQ	✓		✓
Level of Use Questionnaire	LoUQ			✓
Training evaluation questionnaires		✓	✓	✓

Note. CBAM=Concerns-Based Adoption Model (Hord, Austin-Huling, Rutherford, Hall, 1987).

Preservice teachers. Pretest and posttests were administered to all preservice teachers to assess changes in technological proficiency and use, as well as attitudes and concerns. Measures included: Self-Evaluation Rubrics for Basic Computer Use (BCU), Advanced Computer Use (ACU), and Internet Use (IU), Stages of Concern Questionnaire (SoCQ) and the Level of Use Questionnaire (LoU). Parametric paired-sample t-tests assessed differences across semesters. In addition, preservice teachers completed evaluations at the end of each semester to assess the utility and quality of their experience.

Supervising and mentor teachers. Both supervising and mentor teachers completed training evaluations to assess the quality and utility of training. In addition, supervising teachers also completed instruments to assess technological proficiencies, attitudes, and use. Supervising teachers completed Self-Evaluation Rubrics for BCU, ACU, and IU at the end of their semester as supervising teachers. Quantitative results were compared with those for preservice Residents. Qualitative analyses were conducted for open-ended items on questionnaires completed by email and on session evaluation forms by both supervising and mentor teachers.

University instructors. Data were collected on instructors' stages of concern, levels of use, and perceptions of the utility and quality of training. The Concerns Based Adoption Model (CBAM) was used to assess university instructors' progress toward the use of Blackboard courseware. Pretest and posttest data were collected for the SoCQ and Levels of Use. Parametric paired-sample t-tests assessed differences across time. Qualitative analyses were conducted for open-ended items on session evaluation forms.

Findings

Preservice Teachers. Findings reported represent the experiences and perceptions of approximately 110 preservice teachers in cohorts 2 and 3 who progressed through LINKS experiences during the fall 2000 and spring 2001 semesters. Results for preservice educators revealed that participants considered themselves more technologically proficient after experiencing LINKS project activities, with statistically significant pretest and posttest differences for all domains of the BCU, 10 out of 11 domains on the ACU, and all domains on IU. Preservice teachers moved toward higher impact concerns and relatively low self-concerns as measured by the SoCQ. Qualitative analyses revealed generally positive acceptance of and comfort with technology, as well as confidence in curricular integration of technology. Major findings are as follows.

Preservice teachers at TWU experienced a broad array of technology activities. Over three semesters, preservice teachers progress from initial orientation and skill building as Intern I(s) toward increasing emphasis on classroom integration of technology through field-based experiences as Intern II(s) and Residents. Activities allowed preservice teachers to acquire competencies related to technology foundations, connectivity, productivity, and integration through coursework, desktop conferencing, lab learning opportunities, and distance learning via TechTrek and documented through the Technology Passport.

These students became increasingly positive about their technology experiences as they progressed over three semesters of coursework. During their introductory semester, Intern I(s) provided lower quality and utility ratings for LINKS activities. Their reactions suggested that some preservice teachers were initially uncertain about the value of integrating technology. However, as preservice teachers progressed to Intern II, they were more positively disposed toward building proficiencies and using technology, and they had a better understanding of integrating technology into instruction. As students advanced to Residency, they maintained their positive opinion of their own technology abilities and the helpfulness of LINKS activities.

Gains were reported in knowledge and skills, abilities, confidence, and awareness. Regardless of student cohort or level of experience, preservice teachers indicated that LINKS activities contributed to improved technology knowledge and skills, gains in ability to integrate technology in a variety of forms, increased confidence using technology, and awareness of the availability and importance of technology resources.

As preservice teachers' level of experience increased, their concerns regarding technology changed. Over the three semesters, as preservice teachers acquired technology proficiency and became increasingly involved in field-based experiences, they were less concerned about their personal knowledge and skills and ability to integrate technology

effectively in the classroom and more concerned about resource quality and availability and time constraints on technology use.

As a result of LINKS activities, preservice teachers became significantly more proficient technology users. On all BCU dimensions (e.g., operation, file management, word processing, and spreadsheet), statistically significant gains emerged in preservice teachers' perceived proficiency. The strongest improvements were from Intern I to Intern II, but Residents also made significant gains. Preservice teachers also became more proficient Internet users. Intern I(s), Intern II(s), and Residents showed significant gains on all eight IU domains over time (e.g., basics, search tools, obtaining and using files).

Residents attained higher proficiency levels in advanced computer use. Consistent with BCU and IU results, significant gains were evident for Residents on all ACU dimensions (e.g., instructional software use, modification of instructional delivery, assessment of student performance), except education program individualization.

Preservice teachers technology concerns, as measured by the SoCQ, were related to their level of experience. Intern I(s) initially had high informational and personal concerns about technology as well as rather intense consequence and collaboration concerns. As students progressed to Intern II, awareness and informational concerns decreased significantly and impact concerns intensified. As preservice teachers moved from Intern II to Residency, self-concerns (awareness, informational, personal) diminished and impact concerns (consequence, collaboration, refocusing) intensified, although not significantly.

Mentor and Supervising Teachers. Approximately 30 mentor teachers participated in specific technology training through the LINKS project, and 15 supervising teachers who were paired with Residents during their student teaching experiences participated in intensive technology seminars. Interestingly, supervising teachers indicated less technology proficiency

overall, and scored lower than Residents on all domains on the self-evaluation rubrics for BCU, ACU, and IU. Qualitative analyses of open-ended items indicated that supervising teachers were generally positive about technology integration, and being paired with a Resident appeared to be a supportive factor. Concerns related to time, resource quality and availability, and personal skill proficiency. Major findings are summarized below.

Mentor and supervising teachers were generally positive about LINKS training and reported personal technology growth. As a result of LINKS training, mentor and supervising teachers reported improvements in technology knowledge and skills and their ability to integrate technology in the classroom. This group's primary concerns with technology related to time, resource availability, and personal proficiency. Teachers expressed personal and management concerns with the time required to learn about and use technology, limited access to classroom computers and the Internet, and their general lack of technology proficiency. Preservice teachers appeared to positively influence classroom teachers' disposition toward technology. Compared with mentor teachers who interacted only occasionally with interns, supervising teachers who were paired with Residents for the student teaching semester expressed more motivation to use technology and more confidence in their ability to integrate technology.

Compared with their supervising teachers, Residents consider themselves more proficient technology users. In every domain, Residents' BCU mean ratings (both before and after student teaching), exceeded those of their supervising teachers. In most ACU and IU domains, supervising teaches reported lower proficiency levels than Residents. Overall, it appeared that well-trained preservice teachers have the potential to positively influence the curricular integration of technology as they enter the Texas educational system.

University Instructors. The LINKS project provided a wealth of training opportunities for TWU faculty volunteers relative to the teacher preparation program and to online course

development via Blackboard. The project introduced a diverse group university faculty members to the LINKS project and resources, and supported instructor delivery of web-based courses as models for future teachers. Volunteers from 10 university disciplines contributing to teacher education at TWU participated in LINKS training. Personnel from various campus departments collaborated with LINKS staff to deliver staff development for instructors. This included personnel from Information Technology Services, the Distance Education Support Team, Library Services, and the University Blackboard administrator to deliver training. As the result, the training model supports the institutionalization of LINKS activities.

Descriptive statistics and profiles for the SoCQ suggest that instructors' self-concerns declined while task and impact concerns heightened. The majority of participants moved toward higher levels of technology use. Qualitative analyses of open-ended evaluation items revealed concerns with their own ability, the time needed, and the applicability of their new learning. The following are key findings.

LINKS training was tailored to accommodate instructors' broad range of technology abilities. LINKS supported instructor development through whole-group sessions geared to a variety of topics supporting instructors' proficiency for web-based course delivery and hands-on sessions for skill remediation or advanced work. Fourteen sessions were available throughout the year, and all training materials were available on a "class" Blackboard web site. Training encouraged meaningful learning by converting faculty's own course materials to the electronic medium and by providing one-on-one assistance from LINKS staff on request.

Implemented activities raised university instructors' awareness of technology proficiencies needed by future Texas teachers. The introductory LINKS training session oriented university instructors to the required technology proficiencies for preservice teachers preparing to enter Texas classrooms, activities designed to build proficiency, and the processes used to

document student growth. This early orientation was an important component in building awareness of the faculty member as to the state and national expectations for technology integration standards.

The training positively impacted university instructors' motivation to use and capacity to integrate technology as the participants reported increased motivation to use technology and enhanced capacity to integrate technology into their courses. Faculty participation varied by session, and university instructors who participated in more advanced sessions in the spring semester were more motivated to use technology and believed they could use technology more effectively compared to participants in fall training sessions. Instructors' most important learning usually coincided with session topics (e.g., logistics of Blackboard, Internet search engines, HTML). Instructors also noted heightened awareness of technology resources (online library and database resources) and gains in their knowledge of the LINKS project and its benefits.

Instructors' main concerns centered on time, personal skill proficiency, skill retention, and resources. Instructors frequently mentioned a need for time to learn, assimilate information, practice skills, and adapt course materials. Typical concerns about technology proficiency included lack of familiarity, personal inadequacy, learning terminology, and retaining technology skills. Instructors also expressed concern with the availability and quality of resources, their ability to integrate technology, and a need for continued technology support after sessions concluded.

Instructors' concerns with Blackboard implementation, as measured by the SoCQ, changed over time. SoCQ outcomes suggested, that as a result of training, instructors' initial awareness and information concerns had decreased significantly by spring 2001. Management, consequence, collaboration, and refocusing concerns intensified, although not significantly.

These types of findings are consistent with an individual who is progressing through the change process.

Progress toward higher levels of Blackboard use varied for particular instructors. Results for 13 instructors with pretests and posttests on the LoUQ showed that individuals could typically be categorized into three implementation groups. (1) novice Blackboard users who progressed toward higher levels of use, (2) mechanical Blackboard users who made strong developmental growth, and (3) individuals who showed limited growth in Blackboard use, remaining at the same level of use over the two semesters. Progressive instructors generally had low informational, personal, and time management concerns, while stable instructors reported extremely high personal concerns as well as high consequence and collaboration concerns. Five university instructors reported limited developmental growth from pretest to posttest as measured by the LoUQ. When examining instructors' concerns regarding Blackboard, mean SoCQ ratings showed these instructors had very high personal concerns as well as important concerns with the consequence for students and collaboration with colleagues. In contrast, they had very low informational and management concerns. All in all, it seemed that instructors who considered the personal costs for using Blackboard too high (e.g., time and technology proficiency building) remained uneommitted to Blackboard implementation.

These findings provide support for the underlying theoretical foundation of the LINKS project endeavor. That being, change is a process, not an event and that in order to ensure true adoption of an innovation, it is necessary to understand the level and stage at which an individual operates while acquiring new skills. Within the scope of this project, this information was utilized by the LINKS team so that those considerations were part of training development and implementation.

Institutionalization of Technology Initiatives. Evaluation findings for year two as well as information collected from project staff indicate that the LINKS PT^{3}grant has moved TWU toward the infusion of technology into the teacher education program and the University as a whole. From project inception, LINKS considered ways to institutionalize grant activities. Research shows that one grant or one university entity cannot support technology integration in teacher education. Instead, integration relies on a combination of people and departments working toward elements of a strategic plan. The strategic plan at TWU, which was used as a guide for the LINKS PT^3 proposal, aims for students to be exposed to technology in all courses. Thus, LINKS staff collaborated with other university departments to deliver training for university instructors, and university participants were drawn from various disciplines contributing to teacher education. Presenters from various campus departments delivered training and informed participants on available resources. This approach allowed participants to explore TWU's unique distance learning issues, promoted the concept of "university without walls," and supported the transfer of information through a variety of technological mediums to everyday learning with students.

LINKS resources have been integrated with other university initiatives and external and internal funding. LINKS applied for and received an Intel Teach to the Future Pre-Service grant in the amount of $40,000 to support the training of four university instructors and 289 preservice teachers. Each instructor received a laptop computer, a $2,000 stipend, training materials for 75+ students, and attended technology integration workshops on the Intel Teach to the Future curriculum. Participating faculty then redelivered training to preservice teachers within their respective classes. This project enabled LINKS to systematically train faculty to utilize the concept of technology integration into the curriculum as part of their teacher preparation coursework, thus ensuring learning "with technology" instead of "about technology" within a

more meaningful context. In addition to the Intel project, LINKS collaborated with TWU to provide summer training institutes for faculty in online course development. A cost-sharing plan involving TWU ($32,000) and LINKS ($19,000) provided $4,000 stipends for instructors from a wide range of disciplines to develop technology integrated courses as a part of a planned online curriculum.

A growing cadre of university instructors have been oriented to the technology needs of preservice teachers and introduced to online course delivery via LINKS training and activities. Through year 2, more than 50 university instructors have either participated in LINKS training or received support from the LINKS center. An additional 23 instructors will be trained during year three. Disciplines represented by participants include Biology, Chemistry and Physics, Family Sciences, Health Studies, Kinesiology, Performing Arts, Philosophy and Psychology, Reading, Teacher Education, Visual Arts, as well as other university disciplines. This aspect is highlighted to indicate the importance of placing responsibility for the education of the preservice teacher within the University setting rather than only within the College of Professional Education.

The final goal of institutionalization will be supported in four major ways: (1) required technology courses included within basic certification sequences, (2) ongoing professional development provided for faculty and focusing on integration of technology in pedagogy and learning, (3) expanded technical support for preservice teachers by LINKS personnel, and (4) appropriately designed teacher stations in large classrooms serving preservice teachers.

During the third and final year of the LINKS project, preservice teacher activities have been redesigned as integrated technology courses as a part of the university teacher education requirements. Beginning in fall 2001, preservice teachers completed a sequence of courses and requirements designed to support technology integration. A three-course sequence included Education (EDUC) 3001—Integrating Technology for Effective Learning, EDUC

4001—Integrating Technology into Instruction and Assessment, and EDUC 5131—Technology in Assessment and Instruction. These course were taken as co-requisites with associated teacher preparation coursework. This approach, rather than a separate methods course, was implemented to encourage technology integration. Prior to taking these courses that begin in the junior year, students must (a) pass a computer literacy test, (b) pass a computer methods course designed for teacher educators (offered through Math and Computer Science), and (c) pass an information literacy course designed for teacher educators (offered through Library Information Science and the Department of Reading). This revised format involved extensive interdisciplinary collaboration for the education of the preservice teacher between the Colleges of Professional Education and Arts and Sciences and offers a wide range for student skill development over time.

LINKS activities have been extended to the post baccalaureate teacher preparation program (i.e., preservice teachers who have received a degree and are seeking initial teacher certification). In year 3, six university instructors will design and implement online technology infused methods courses for post baccalaurate students. Through a unique mentoring approach, experienced faculty from the Library of Information Science will function as mentors and expert facilitators of curriculum development to each of the six identified Teacher Education faculty.

Lines of communication sustained by LINKS staff during a change in university leadership supported project success. During the first implementation year of the PT^3 grant, TWU made changes in university leadership. LINKS staff met with the new president, provided an overview of project initiatives, and suggested ways to align university and grant initiatives. Staff also worked with the new Dean of the College of Professional Education to raise awareness of technology integration needs. These communication efforts resulted in increased funding for years two and three of project, administrative support for technology integration, alignment of

the LINKS initiative with university efforts and, ultimately, support for institutionalization efforts.

Summary

This study's purpose was to describe changes in TWU's institutional processes as well as changes in behaviors and attitudes of faculty, mentor and supervising teachers, and preservice teachers. Specifically, the study addressed these questions: (a) how did LINKS support technology infusion in teacher preparation, (b) to what extent did preservice teachers build technological skills and understanding, (c) how did mentor and supervising teachers build technological skills and serve as guides of technology integration, (d) to what extent did university instructors build proficiency for web-based course delivery and model technology integration for preservice teachers; and (e) what progress was made toward infusion of technology into classroom courses across disciplines, education courses in particular, and the university overall?

Five findings summarized and related to the associated study questions are as follows:

a. LINKS infused technology into the teacher preparation program with a three pronged approach: training for students, mentor teachers and supervisors, and university faculty. Each group was supported in multiple ways including to the Technology Passport for Students, TechTrek, and LINKS web page resources.

b. Preservice teachers (N=110) evidenced statistically pre and posttest differences on all domains of BCU and on 10 out of 11 domains on Advanced Computer use.

c. Mentor teachers (N=30) participated in on-campus LINKS training designed to enhance receptivity to technology use. A select supervisor group (N=15) came with their Resident for training dedicated to development, implementation, and evaluation of a classroom

technology project. Supervising teachers indicated less technology proficiency overall than their Residents.

d. Faculty volunteers (N=20+) for LINKS training were supported in their development of web-based course delivery using Blackboard. The faculty involved included members from the College of Arts and Science as well as those from the College of Professional Education.

e. Overall, the infusion of technology across disciplines as well as in the College of Professional Education is evidenced by the integrated structure of the undergraduate program, the distance education delivery of the new post-baccalaureate teacher certification coursework and the new Masters in Art Education which includes extensive amounts of technology integration in relationship to both the learning process and course delivery. These unique projects were begun by faculty who participated in the LINKS project which provides evidence to support the assumption that the LINKS training enhances faculty ability to model effective utilization of technology in teaching and learning.

Educational Importance

Findings regarding the implementation and effectiveness of the LINKS project have implications in at least three specific areas. First, in demonstrating how university professors can be supported as effective models of technology use in web-based course delivery and electronic communication with students. Next, in demonstrating how technology proficiencies of entry-level teachers can be increased to address state and national expectations, and finally, in modeling how other universities might undertake similar changes in teacher preparation programs. The LINKS web site contains a number of project-related resources, such as the Technology Passport, that are available for use by other institutions. Documentation of learner-

centered standards for preservice teachers through the Technology Passport provides a much-needed model to monitor and assess changes in preservice teachers' technological proficiencies in relationship to the Texas Education Agency's Learner-Centered Proficiencies for Texas Schools.

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